

## A TIDAL PROBLEM

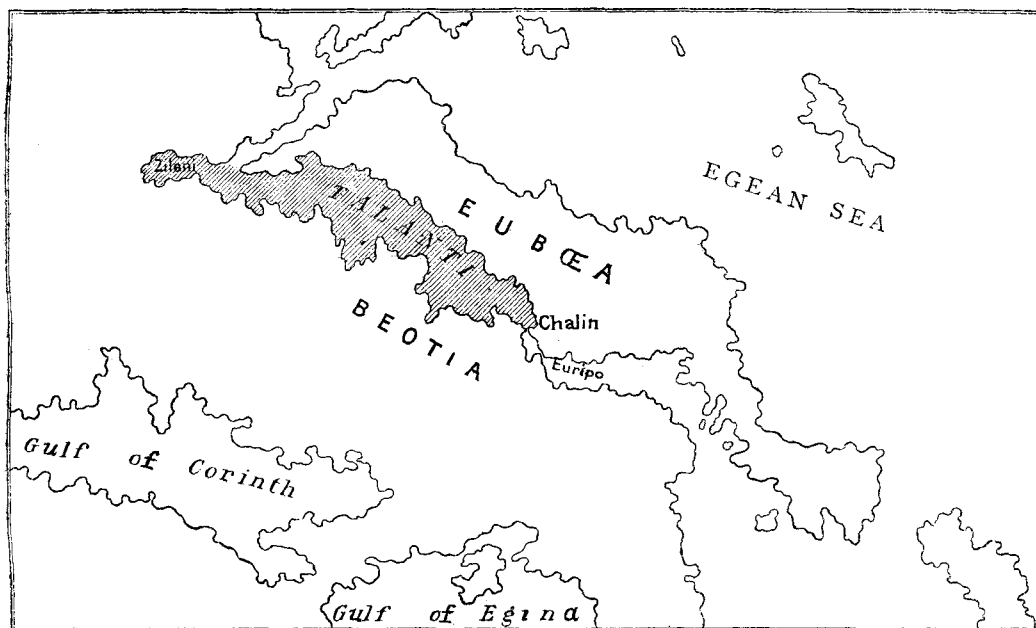
THE so-called *seiches*, or alternate flux and reflux of water in the Lake of Geneva and other bodies of fresh water, have, as our readers know, formed the subject of an interesting study during the past decade by Dr. F. A. Forel, of Morges, near Geneva. Small local tides are constantly noticeable there, the difference between ebb and flow varying from a few centimetres to 2 metres. Their cause is to be traced to the wind, variations in atmospheric pressure at the extremities of the lake, &c. Dr. Forel, as the result of his investigations has established a formula by means of which the duration of a local ebb and flow can be determined—not only for the Lake of Geneva, but for any lake—when its average depth and its length are known. The following is the formula  $T = 2 \frac{2L}{\sqrt{gh}}$ , in

which  $L$  denotes the length of the lake,  $h$  its average depth, and  $g$  the acceleration of gravity. This formula gives for the Lake of Geneva, which has a length of

73 kilometres, a duration of tide of 13 minutes; a figure coinciding with the fact.

The law thus established by M. Forel has recently received an interesting application in solving a problem which has puzzled travellers and philosophers for over 2,000 years, viz., the explanation of the currents in the narrow straits of Euripus, where the famous five-arched bridge of Egripo joins the Island of Eubœa to the mainland of Greece. The currents sweeping below the bridge are so violent that mills are kept in operation by them, but they are noted for the changes in direction which occur from four to fourteen times daily. Tradition relates that Aristotle, in despair at his inability to explain this phenomenon, threw himself from the bridge into the water.

A comparison of the large number of observations made upon this strange tidal movement shows that there are two distinct periods: that in which there are but four changes of direction or two tides in a lunar day of 24 hours and 50 minutes, and that in which these tides number from eleven to fourteen daily. This latter phenomenon is observable invariably at the quadratures of the



moon. M. Forel, in his explanation, shows that the regular ebb and flow twice a day in the former period is due to the tidal movement of the Aegean Sea, which is then at its maximum. The increase in the number of tides daily becomes manifest, however, when the tidal force of the Aegean is at its minimum, viz., at the quadratures, and must be owing to some other force more powerful than the minimum but less powerful than the maximum force of the Aegean tide. This force is found in the local tides or *seiches* of the Gulf of Talanti to the north of the straits, which is so shut in by land that it can practically be regarded as subject to the same laws as the lakes of Switzerland and other countries. This basin is 115 kilometres long, and is from 100 to 200 metres in depth. Applying these figures to M. Forel's formula, the ebb and flow in the Gulf of Talanti would be for 100 metres, 122 minutes; for 150 metres, 100 minutes; for 200 metres, 86 minutes. The eleven to fourteen currents observable daily at Euripus during the quadratures last from 103 to 131 minutes. This shows so striking a conformity with the theory advanced by the Swiss *savant*, that we can but consider this problem, which so vexed the ancients, as fairly solved.

Dr. Forel asks intelligent visitors to the locality to verify his interpretation by attending especially to the following points:—1. Ascertain the exact duration of the flux and reflux of the Euripus, and determine its normal rhythm. 2. Ascertain if, as in the *seiches* of the Lake of Geneva, the amplitude of the flux and reflux of the irregular current is stronger in bad weather than when there are no atmospherical perturbations. 3. Ascertain if the connections between the direction of the current and the flow of the rising sea are, as he supposes, inverse, according as the current is regular or irregular.

## NOTES

THE great osteological collection which Dr. Barnard Davis, F.R.S., has accumulated during a long life devoted to anthropological pursuits is well known, both in England and abroad, as the richest and most valuable ever formed by a private individual, exceeding, as it does, in variety and rarity of the specimens all the public collections of this country and most of those on the Continent. It contains about eighteen hundred specimens of skulls and skeletons of various races of men, the value of

which is greatly increased by an excellent catalogue, called "*Thesaurus Craniorum*," in which each is fully described, and all known particulars of its history recorded. We believe that, at one time, Dr. Davis contemplated leaving the collection to the College of Surgeons; but considerations for the interests of his family do not appear to have justified this arrangement, and he has now offered it for the sum of 1,000*l.*—which, considering its extent, and the labour and time taken in its formation, must be considered very moderate. Upon this becoming known to the Council at their meeting on December 11, through a communication of Prof. Flower, we learn from the *British Medical Journal*, it was the unanimous feeling of all present that the opportunity of acquiring it upon the terms offered by Dr. Barnard Davis should not be lost. It was referred to the Museum Committee to consider and report whether the necessary sum could be provided out of the College funds, or whether it was desirable to seek for aid from other sources; for the latter alternative several liberal offers were at once made by individual members of the Council. We feel sure that all who are interested in the scientific progress of the country will have great satisfaction in knowing that the Council of the College have thus promptly stepped forward to save this noble collection from dispersion or expatriation; and that, if it should be thought that the College funds cannot judiciously be taxed at the present time, the country will as promptly respond to an appeal for such a truly national purpose. The Hunterian Museum, thus enriched, would more than ever become the great centre of osteological and anthropological research and instruction, and in the hands of Mr. Flower we may be sure that this collection would be so arranged, developed, and studied as to be rendered in the highest degree available for the advancement of knowledge. It is an opportunity which must not be let pass.

THE following translation of a Chinese placard regarding the highly immoral practice of consuming cow's milk is sent to the *Foochow Herald* for publication:—"Strictly refrain from eating cow's milk! Man should not rob the beasts of their food. Moreover of all beasts the cow is the most useful and meritorious. Men who do not discriminate between mankind and beasts are worse than senseless. Those who sell milk darken their consciences for gain, and those who eat cow's milk foolishly think they are benefiting their bodies. Men who take medicine should first carefully investigate and find out its nature. Why do not those who eat cow's milk consider and inquire into its origin? For instance, men beget children, and while the children are small they depend upon milk for their nourishment; so it is also with beasts. But when men buy milk to eat, do they not do injury to the life of the calf? And is there not bitter hatred and distress in the minds of both cow and calf? Beasts cannot speak: how then are they able to tell the man that, in eating the milk of beasts, his body becomes like that of birds and beasts? But if men wish to take strengthening medicine, there are numberless other articles in the world that are beneficial; and what necessity then is there for taking cow's milk? Besides this, the death and life of men have their fixed number and limit, and this cow's milk cannot lengthen out and continue the life of man. Since, then, all know the truth—that it cannot do this, all ought to act with loving and benevolent spirit. Especially all who receive this exhortation should keep from eating milk. The children of those who cause their families to refrain from eating milk will be preserved to grow up; they also will thus lengthen out their own lives, and will escape from evil in time of fatal epidemics. If such persons be able also to exhort others, who are ignorant of first principles, to leave off the eating of milk, their descendants shall surely prosper. Published by the Hall of Good Exhortations. The Xylographic blocks are deposited in the Ung Ling Kóh."

AN important discovery has just been made in the neighbourhood of Elbœuf, Seine-Inférieure, by M. Noury. He has found a multitude of pre-historic implements in the siliceous sands which form the sub-soil of the Seine valley, between Elbœuf and Rouen. In a single locality he collected more than 400 among bones of large quaternary mammals. These implements are said to belong to the palæolithic age; they consist of cut flint forming axes, cores, punches, and hammers of various dimensions.

WITH reference to the discovery of a jade scraper at Geneva referred to in *NATURE*, vol. xxi. p. 163, Prof. Max Müller writes to the *Times*:—"Scrapers or cutting instruments made of real-jade are very rare, in Switzerland and elsewhere, but I have myself seen several beautiful specimens—among the rest, one found by Dr. Uhlmann, of München-buchsee, whose collection of lacustrine antiquities, all taken out by his own hand from one and the same small lake, the Moossee-dorfsee, is perhaps the most authentic and most instructive collection in the whole of Switzerland." Prof. Müller does not see any difficulty in believing that the early "Aryan" immigrants into Europe brought with them and preserved, "from generation to generation, so handy and so valuable an instrument as a scraper or knife, made of a substance which is *are perennius*." On the same subject Mr. B. M. Westropp sends the opinion of M. Desors, as follows:—"We cannot share the opinion which attributes extensive commercial relations to the tribes of the age of stone. In support of this opinion are cited the hatchets of nephrite (jade), of which numbers are found at Concise and other stations of that epoch; and as this stone now comes to us from the East, it has been inferred that the tribes of the remote period in question trafficked with Asia. But it should be remembered that the greater part of the hatchets which are assumed to be nephrite may very well be only varieties of indigenous rocks, proceeding from siliceous veins in the serpentine, and whose depository might be found, according to M. de Mortellet, in the higher Maurienne. It seems to us very difficult to admit that so distant a commerce should have been restricted to the exchange of certain stones, which, after all, are not very superior to common silex, while the East might have furnished objects of far greater utility, particularly metals."

ONCE more the New York correspondent of the *Daily News* telegraphs of Mr. Edison's success in electric lighting. "Mr. Edison," we are told, "has perfected an electric lamp of extraordinary simplicity, costing only 25 cents, with which he proposes a general illumination of the village of Menlo Park on New Year's Eve. He has discovered that a steady brilliant light is obtained by the incandescence of mere carbonised paper better than from any other known substance. Strips of drawing paper in horse-shoe form are placed in a mould and baked at a very high temperature. The charred residuum is then attached to the platinum wires and hermetically sealed in a glass globe from which the air has been exhausted. This attached to a wooden stand, or ordinary gas fixtures, is the whole lamp. No regulating apparatus is required, the flow of electricity being automatically increased and diminished at the central generating station. A single generating machine of simple construction, and applicable for domestic use, supplies about fifty lamps. The cost of the power is not stated. The quantity of electricity supplied to each householder is measured by the deposit of copper particles in an electrolytic cell."

M. A. GUYARD claims to have discovered another new metal of the platinum group which he names *uralium*, from the Ural Mountains, whence the ore is procured. There have been quite a flood of similar announcements lately. We have now gallium, davyum, mosandrum, neptunium, decipium, phillipium, nor-

vegium, scandium, ytterbium, holmium, "X," thulium, and uradium. Chemists will have to keep as narrow a watch on these minor elements as our astronomers do upon the minor planets, or we shall not know where we are.

IN a paper on the destruction of obnoxious insects, by Prof. Hagen, of Harvard, in which he describes some experiments that had been made by Mr. J. H. Burns and others, he comes to the following conclusions:—1. That the common house-fly is often killed by a fungus, and that in epizootics a large number of insects which live in the same locality are killed by the same fungus. 2. That the fungus of the house-fly works as well as yeast for baking and brewing purposes. 3. That the application of yeast on insects produces in them a fungus which becomes fatal to the insects. 4. That, in the experiment made by Mr. J. H. Burns, all potato-beetles sprinkled with diluted yeast died from the eighth to the twelfth day, and that the fungus was found in the vessels of the wings. He admits that further experiments are necessary to find out the most convenient method of application.

WOOLWICH is taking a step ahead in the use of the electric light, a number of tradespeople in that suburb being now supplied by Messrs. Siemens, who have set up for that purpose three of their most powerful machines. Power is supplied from the steam-engines of Messrs. Rose and Mellish's establishment on the river bank, when the day's work is over. The lights are maintained from 6 P. M. till midnight.

A CORRESPONDENT sends us the following account of the recent severe weather at Mulhouse; it is contained in a letter from Mr. Alfred von Glehn:—"I must give you some description of the fearful weather we had last Friday (December 5). No one here ever remembers such a day. On Thursday night it began to rain, the thermometer being about 8° below freezing, then came lightning and thunder, and then the most terrible wind got up, with driving snow; it lasted all night and next day. It blew a hurricane, thermometer about 20° F. below freezing, and all the time the snow fell so thick that you could not see a yard before you. I really hardly know how I got to the works; one could hardly breathe, and at certain open places one could hardly stand, and I saw people have to turn back and take refuge in shops. No trains could run; one was stopped between here and Bâle, and the people had to come back as best they could on foot. A goods train was snowed up between here and Cernay, and was only got out on Sunday. Two factory chimneys were blown down, and numberless smaller accidents occurred. We had to allow the workmen who live in the country to start for their homes at three o'clock in the afternoon, as at night it would have been impossible for them to find their way. Everywhere in the streets stood carts abandoned by their owners, as the horses could not move them. One train was got ready for Strassburg, with four engines, but it stuck just outside the station, and could go no farther. The next day the weather was fine and cold. Sunday night the thermometer fell to 40° F. below freezing, and at 12 o'clock in the middle of the day with a bright sun stood at 0° F. This morning it went down to 51° F. below freezing, and when I went to the works it was only a few degrees less. The air is fortunately still, and as there has been bright sunshine everything is wonderfully beautiful. Skating is unfortunately out of the question, owing to the masses of snow. Sledges are to be seen on all sides, even the cabs are mostly sledges, and those who have horses are to be envied, as the roads are in a splendid state."

THE *Derry Journal* of the 10th inst. states that on the previous Saturday, at about 11.30 P. M., the inhabitants of Stranorlar, county Donegal, and for many miles around, were startled with

a strange and unusual sound. It resembled the noise produced by the falling in of a large building, and in some cases the commotion was so powerful that chairs and other household articles were seen to move. The phenomenon is believed to be a slight convulsion of earthquake, and much resembled distant thunder. Mr. Thomas Watson, of Derry, writes that a similar disturbance was noticed at exactly the same hour at Barons Court, the seat of the Duke of Abercorn, in county Tyrone, and was sufficiently intense to cause the candelabrum in one of the large rooms to shake very perceptibly, the noise at the same time being very loud, and of a nature that puzzled those who heard it to explain. It seems to have been in some way connected with an earthquake wave which appears to have taken the direction almost east and west.

IN a recently-received report from Guayaquil, it seems that the bad season of 1878 had a most serious effect upon the produce of the soil in that country. The cocoa crop (*Theobroma cacao*) was the smallest on record, though the high prices obtained for this article in the European markets have in some degree compensated for the loss. The coffee crops gave even a worse result, as during the last months of the year it was found necessary to import coffee from Central America for home consumption. The quality of the coffee produced in Guayaquil during the year was very inferior. The rice plantations having been almost entirely under water, owing to the heavy rains, for a long period during 1877 and 1878, the production of this article of food (of which, in the coast provinces of the Republic alone, 5,600 quintals per month are consumed) was very limited. The cotton plantations were also destroyed by the same cause. The failure of the above-mentioned crops left a large number of men free to attend to the collection of india-rubber and ivory nuts. The export of the former during 1878 was a little below that of the preceding year, owing doubtless to the scarcity of the trees producing it, and the difficulties of bringing it down to the coast from the inland forests, where it is gathered, each year made more distant from the ports of embarkation owing to the continued wanton destruction of the trees. The quantity of ivory nuts gathered and exported by far surpassed all previous years.

THE *Pharmaceutical Journal* of December 20 contains a valuable report on the botany of the Kuram and Hariab districts, by Surgeon-Major J. E. T. Aitchison.

A NUMBER of papers on the hymenoptera and coleoptera of the United States, by Messrs. E. Norton, C. A. Blake, and Dr. Horn, are in course of publication in the *Transactions* of the American Entomological Society of Philadelphia.

FROM the *American Naturalist* we learn that Thos. G. Gentry is engaged in a work on the fertilisation of plants by insects, based on observations made in Pennsylvania and New Jersey, and that Prof. O. S. Jordan is preparing a work on the Fishes of North America.

A FAVOURABLE report was presented at the last meeting of the Eastbourne Natural History Society.

IN a recent volume of the *Ann. de l'Obs. Roy. de Bruxelles* (September, 1879, 84 pp.) M. Fievez gives a comprehensive bibliography of works, treatises, and notices on spectroscopy. An index facilitates the search for any particular point relating to the subject.

THE Russian Technical Society will hold an exhibition of the latest Russian and foreign technical machines, apparatus, instruments, and inventions, from December 15 until May 15 next, at St. Petersburg.

A PAPER of great value on the Geology of the Lower Amazons, by Mr. Orville A. Derby, read before the American Philosophical Society, has been issued in a separate form.

THE *Transactions of the Cumberland Association for the Advancement of Literature and Science for 1878-9*, is a volume of 340 pages, edited by the Rev. J. Clifton Ward. Among the numerous excellent papers contained in the volume are the following:—An ethnological paper by Mr. R. S. Ferguson, entitled "The Formation of Cumberland;" "Our Summer Visitors," a local natural history article, by Mr. T. Duckworth; an interesting paper on the Dipper (*Cinclus aquaticus*) by Mr. William Duckworth; "The Entomology of the District," by Mr. George Dawson; "The Great Lake, Lagoon or Bay of Triton," by Mr. B. A. Irving; "List of Cumberland Birds in the Carlisle and Keswick Museums," by Mr. George Dawson and the Rev. J. Clifton Ward.

### PHYSICAL NOTES

SOME useful observations on the action of safety valves on boilers have been recently communicated to the Vienna Academy by Herr von Burg (November 13). Among other things it is proved that the authoritative directions given in different countries as to the size of safety valves are not at all adequate, and are based on erroneous conceptions. As to the cause of the small amount of lifting of the valve during escape of steam (seldom over  $\frac{1}{2}$  mm.), the author at first supposed a vibratory motion of the valve, but further study and experiment led him to the hypothesis that the steam jets, in lifting the valve, do not begin to move from its middle point, but from the periphery of a circle,  $p$ , out to the circumference of the valve of radius  $r$ ; so that the pressure of steam on the under surface of the valve is composed of two parts, of which the inner, or *aerostatic*, is produced by the solid steam-cylinder of radius  $p$ , and the outer or weak *aërodynamic* part, by the external hollow cylinder of  $r-p$  thickness of wall. The phases of development of steam tension, and other topics, are also investigated.

A SIMPLE method of perforating glass with the electric spark is described by M. Fages in a recent number of *La Nature*. The apparatus required consists (1) of a rectangular plate of ebonite, its size, for a coil giving 12 ctm. sparks, about 18 ctm. by 12; (2) of a brass wire passing under the plate and having its pointed end bent up and penetrating through the plate (not further). This wire is connected with one of the poles of the coil. A few drops of olive oil are placed on the ebonite plate about the point, and the piece of glass to be perforated is superposed, care being taken not to imprison any bubbles of air. The olive oil perfectly accomplishes the object of insulating the wire. One has then only to bring down a wire from the outer pole of the coil, on the piece of glass, above the point of the lower wire, and pass the spark. By displacing the glass laterally, for successive sparks, it is easy to make a close series of holes in a few seconds.

IT has often been queried what might be the reason of the high specific heat of water. Some light has been thrown upon this problem by the recent research of a Russian gentleman of the name of Beketoff, upon the specific heat of the hydrogenium-alloy of palladium, and upon that of the hydrogen-in the alloy. The specimen examined by M. Beketoff contained about half per cent. of hydrogenium to ninety-nine and a half of palladium. On examination by careful calorimetric measurements the specific heat of hydrogenium was found to be not less than 5.88; which though probably requiring correction is certainly not greater than the true value. The value should be somewhere about 6.4 by the law of atomic heat of Dulong and Petit.

A VIBRATION micrometer for ascertaining with precision the amplitude of vibrations of tuning-forks and other sounding bodies was recently shown in Paris by M. Mercadier. It is an extremely simple device and can be applied to any vibrating bodies except such as possess very small mass. A small piece of thin white paper bearing one fine black line is affixed to the body whose vibrations are to be measured. If this line is upright, it will, when caused to vibrate, present the appearance of a pale grey parallelogram, the persistence of the visual impression being perfectly definite for the extreme positions of the vibration. To ascertain the amplitude of the vibration, all that is necessary is to measure the apparent width of this minute parallelogram in a direction at right angles to the axis of symmetry of the oscillations. To do this with still greater precision, M. Mercadier proposes to set the line not perpendicular to the direction of the movement, but inclined to it at a small angle, and marks also

upon the paper a fine scale of lines parallel to the direction of the movement and distant from one another by equal distances of one millimetre. The width of the narrow parallelogram is thus read off along a straight line, which makes a small angle with its sides, thus giving the quotient of the amplitude sought by the tangent of a small angle. Using this method, M. Mercadier showed that the vibrations of a tuning-fork "interrupter," vibrating automatically under the influence of an electro-magnet, may be regulated so as to be greater or less at will by adjusting to a greater or less distance from the prongs of the fork the electro-magnet which maintains the vibrations.

PROF. TAIT has abandoned the enticing speculation that the thermal conductivity of metals is inversely proportional to their absolute temperature, a conclusion to which his earlier experiments on the conductivity of iron seemed to point. Many metals, indeed, present the opposite case, their conductivity increasing with the temperature.

A MEANS of comparing the intensities of lights of different colours has long been desired. Until quite lately there did not even exist a means of measuring the relative intensity of two lights of the same given colour. M. Gouy has been investigating the latter point by the aid of a particular photometer, and by flames of constant brilliancy produced by the combustion of a homogeneous mixture of coal-gas with air impregnated with saline powders. The photometer resembles in general appearance a two-prism spectroscope, having also an auxiliary collimator with a fixed lamp to serve as a standard light. In place of the usual eye-piece of the instrument a second slit is placed. By this means any one ray can be separately observed, and its intensity compared with the intensity of the same ray from the standard source. M. Gouy states that this slit eye-piece arrangement is capable of such accurate adjustment that each of the two D-lines can be separately examined and its intensity measured.

MARAT, the notorious hero of the first French revolution, the same who met his death at the hands of Charlotte Corday, was the author of several important essays on electricity. This fact, which is not generally known, was recently brought to notice by Mr. A. J. Frost, who is editing the catalogue of the Ronalds Library. Most of Marat's works were written between 1779 and 1785, and several of them were translated into German. Marat was not the only one of the prominent figures of the time who worked in physical science. Arago, though his fame does not rest upon his political achievements, once enacted the chief part in the crowning of the statue of Liberty. "Citizen" Charles was as famous amongst the revolutionists as for his scientific attainments. Robespierre wrote an article on the lightning-conductor for the *Journal des Savants*; and last, but not least, Napoleon Buonaparte on many occasions dabbled in scientific lore, and was the liberal patron of men of science.

EDISON'S telephone has, it is said, been successfully used over a line of 2,000 miles in length. A hunting party in Nebraska were thus enabled to converse with perfect distinctness with their friends in Pennsylvania, *via* Chicago and the Western Union Telegraph Company's line.

### GEOGRAPHICAL NOTES

THE Neapolitans are preparing to *fête* Prof. Nordenskjöld, who intends staying a short time in Southern Italy before returning overland to Sweden. The *Vega* arrived at Galle on the 16th inst. We have received from Hongkong an account of the reception given to Prof. Nordenskjöld and the officers of the *Vega*, on arriving at that Eastern limit of the British Empire. At the close of an official banquet at Government House, Governor Hennessy congratulated Prof. Nordenskjöld and his staff in the warmest terms. "We behold," he said, "as it were in this remote outpost of Europe, the writing of the last words in the last chapter of heroic maritime discovery." Captain Palander brought down to the drawing-room the actual charts he had used during the voyage, and throughout the evening they were inspected by the Governor's guests with great interest. The charts were Russian ones, and one of the minor results of the expedition has been the establishment of the fact that they are not accurate, inasmuch as a great deal that was put down as land was actually sailed over by the *Vega*. The route was marked in red ink and pencil and showed these inaccuracies. Some specimens of the plants from the region where the *Vega* was so long bound up in the ice and photographs of the natives were also on the drawing-room tables. We understand